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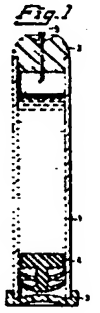
(54) **Method and device for handling blood samples.**

(57) The method involves secluded handling of blood samples. The device for performing the method comprises a container adapted to contain a blood sample and a so-called phase body (4) inserted into the container beforehand, which after centrifugal treatment of the container separates the phases of the blood from each other. The container consists of a tube length (1) each end of which is closed by one pierceable, self-sealing closure (2 and 3 resp.). The blood sample is introduced by means of e.g. a cannula (5) through the one closure (2) and one of the blood phases formed during centrifugation is removed through the other closure (3) by means of e.g. a cannula.

Fig.1



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METHOD AND DEVICE FOR HANDLING BLOOD SAMPLES

Technical field

The present invention is concerned with a method of handling blood samples and a device for performing the method.

State of the art

Known blood sample containers comprise test tubes of glass or plastic having a rounded or conical bottom. It is also known to have the test tubes sealed and a subatmospheric pressure established therein whereby filling is facilitated and filling up to a certain level is achieved.

Moreover, it is known to use silicon oil, plastic balls or a solid body for phase separation between the phases obtained by centrifuging, to wit respectively serum/plasma and blood coagulum. The disadvantage encountered in the known handling method and the known devices respectively resides in that the centrifuged serum/plasma phase has to be decanted into a new test tube for continued analysis. Such decantation of the serum/plasma phase involves an intrinsically time-consuming working step and entails the risk that blood samples from different persons may be exchanged. Moreover, there is a risk of transfer of infection such as hepatite, to the laboratory staff. Due to the fact that at least two test tubes have to be used for every blood sample, consumption of material is a serious

factor. Compare in this connection the United States patent specifications 4.020.821 and 4.027.660, the British patent specification 1.391.053 and the Norwegian patent specification 133.250.

Summary of the invention

It is one object of the invention to eliminate the disadvantages inherent to the known way of handling blood samples and the drawbacks of the known blood sample containers respectively. In performing the method of the invention a blood sample is introduced by means of a cannula or the like into a preferably cylindrical container by piercing a first closure provided in the one end surface of the container. The method is characterized in that the blood-filled container is turned up and down and is subsequently centrifuged, causing a phase body introduced into the container to become submersed to assume a position in which it separates the phases of the blood from each other, the phase to be analysed being removed by means of a cannula or the like from the container by piercing a second closure provided in the other end surface of the container.

The device for performing the method of the invention comprises a container for collecting blood, said container being adapted to receive a so-called phase body which after centrifuging the blood-filled container separates the blood phases from each other, characterized in that the container is an open tube,one end of which is closed by a sealing, pierceable first closure through which the blood sample is introduced, and the other end of which is closed by a sealing, pierceable second closure through which one of the separated phases of the blood is removed.

In accordance with a preferred embodiment a sub-atmospheric pressure is established in the device and at least one of the closures is so dimensioned that the sub-atmospheric pressure

is indicated visually by the formation of a depression in said closure.

Description of the drawings

FIGURE 1 is a cross-sectional elevation of a container according to the invention during introduction of a blood sample with the aid of a cannula shown in the figure.

FIGURE 2 shows the container turned upside down prior to centrifuging of the blood sample.

FIGURE 3 shows the container of fig. 2 after centrifuging.

FIGURE 4 is a partial perspective view of a first embodiment of one of the end closures of the container.

FIGURE 5 is a cross-sectional view taken on line V-V in fig. 4 of the end closure according to fig. 4.

FIGURES 6, 7 and 8 each show different embodiments of one of the end closures of the container.

FIGURES 9 and 10 each illustrate one of two different embodiments of the other end closure of the container.

Description of the preferred embodiments of the invention

Fig. 1 shows a test tube according to the present invention. The test tube comprises a straight tube length 1 of glass, plastic or the like. Either end of the tube length is closed by a pierceable closure 2 and 3 respectively sealing against the tube wall either internally (closure 2) or externally (closure 3). A phase body 4 is provided within the tube length. The phase body does not constitute a part of the present invention and will accordingly not be described in detail. A sub-atmospheric pressure is caused to prevail in the container which is indicated by the fact that the lower closure 3 in fig. 1 is inwardly curved. The blood sample from a patient

is introduced into the container by means of a cannula 5 which is caused to pierce the upper closure 2 as shown in fig. 1. Due to the sub-atmospheric pressure the test tube may be filled to a certain predetermined level, whereafter cannula 5 is removed. In direct connection to taking the blood sample the container is marked to identify the blood-giver, e.g. by means of a label glued onto the container. Alternatively, there may already be a double or multiple identification on the container one part of which is glued onto the patient card.

Fig. 2 illustrates the container of fig. 1 after removal of the cannula and turned upside down. In this position the container is centrifuged. During centrifuging the phase body due to its construction will always move more slowly than the blood corpuscules. The phase body is of resilient material and when the final centrifugal force has been achieved the disc-like element 6 of the phase body will be directed upwardly and the phase body, in a way known, will descent through the blood serum until a state of equilibrium is achieved. After the end of centrifuging the disc-like element of the phase body will seal against the inner surface of the container and the phases will be held separate.

Fig. 3 illustrates the container of fig. 2 after the end of centrifuging with the phase body separating the serum or plasma phase from the blood coagulum phase. With the orientation as shown in fig. 3 the container is transferred to the analyzing station where the separated serum/plasma phase is recovered by piercing the closure 3. It will thus be clear that the container according to the invention reduces the risk of infection because the need for an additional transfer prior to analysis is eliminated. The handling of the blood sample is completely secluded which means that the staff under no circumstances is required to take the risk of coming into contact with the blood sample. Moreover, work is saved and the risk of exchange is reduced. Due to the fact that only one test tube is to be used also the turn-over of

implements is reduced. As the container is a tube length, narrow manufacturing tolerances can be observed both in the tube length and the closures. It is a further advantage of the container of the invention that the losses of blood gases solved in the blood serum are reduced. Also the risk of contamination is lowered. Present-day readers of sample identifications require that the sample identification provided on the container has a certain, exact orientation. As testing and sampling now can be made from one and the same container, such sample identification can be mechanically applied beforehand.

In the embodiment according to figs. 4 and 5 the closure 2 has a depression 7 facilitating penetration of the cannula. Moreover, the closure has a plane upper surface 8 adapted to cooperate with centrifuge sleeves having a plane bottom. Moreover, the closure has a conical internal portion 9. Due to this shape the forces acting on the closure when serving as the bottom of the container during centrifuging will exert a sealing action in respect to prior piercing of the closure.

Fig. 6 shows another embodiment of closure 2. Also this embodiment has a plane upper surface 8 and an internal conical portion 9 but in addition the closure is rounded as at 10.

The embodiment as shown in fig. 7 is similar to that of fig. 6 except that the lower side of the closure is rounded as at 11. The embodiments according to figs. 6 and 7 are adapted to be used in connection with centrifuge sleeves having a rounded bottom.

The embodiment according to fig. 8 corresponds to the embodiment of closure 2 as shown in figs. 1 to 3. A depression 12 corresponds to recess 7 as shown in figs. 4 to 7. The bottom surface 13 of the closure is plane.

The closure according to fig. 9 corresponds to that shown in figs. 1 to 3 but is additionally provided with a lip 14 by

means of which the closure can be removed. In fig. 10 a closure 3 is shown sealing internally within the tube length.

Either closure 2 and 3 may be glued, heat-sealed or otherwise disposed in either end of the tube length. The closures may even be removable. Moreover, obviously either closure must be made of self-sealing material re-sealing itself after piercing and removal of a cannula or the like.

Industrial use

The invention is advantageously used in hospitals and institutes provided with analyzing equipment for blood samples.

The embodiment of the invention as described above may be modified and varied in many ways within the frame of the basic idea of the invention.

WHAT WE CLAIM IS:

1. A method of handling blood samples, wherein a blood sample is introduced by means of a cannula or the like into a preferably cylindrical container (1) by piercing a first closure (2) provided in the one end surface of the container, c h a r a c t e r i z e d in that the blood-filled container is turned up and down and is subsequently centrifuged, causing a phase body (6) introduced into the container to become submersed to assume a position in which it separates the phases of the blood from each other, the phase to be analysed being removed by means of a cannula or the like from the container by piercing a second closure (3) provided in the other end surface of the container.

2. The method as claimed in claim 1, c h a r a c t e r i z e d in that the container in the upside down condition is provided with a sample identification.

3. A device for performing the method as claimed in claim 1 comprising a container for collecting blood, said container being adapted to receive a so-called phase body which after centrifuging the blood-filled container separates the blood phases from each other, c h a r a c t e r i z e d in that the container is an open tube (1),one end of which is closed by a sealing, pierceable first closure (2) through which the blood sample is introduced, and the other end of which is closed by a sealing, pierceable second closure (3) through which one of the separated phases of the blood is removed.

4. The device as claimed in claim 1, c h a r a c t e r i z e d in that a sub-atmospheric pressure is established within the container and that at least one of the closures (e.g. closure 3) is so dimensioned that said sub-atmospheric pressure is indicated visually by the formation of a depression in said closure (3).

5. The device as claimed in claim 3 or 4, c h a r a c t e r i z e d in that the first closure (2) has the shape of a plug inserted into one of the tube ends and having a conical (fig. 4), rounded (fig. 7) or plane (fig. 9 resp. fig. 11) base surface which when the first closure serves as the bottom

of the container during centrifuging exerts a sealing action in respect to a previous piercing of said first closure.

Fig.1

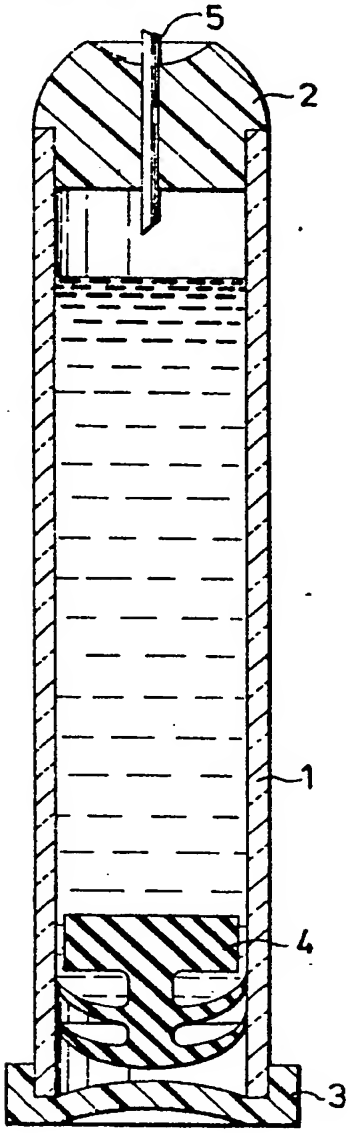


Fig.2

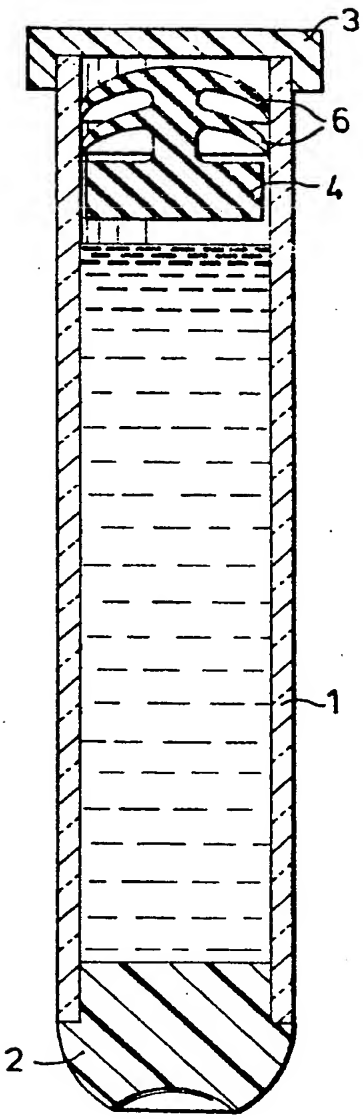


Fig.3

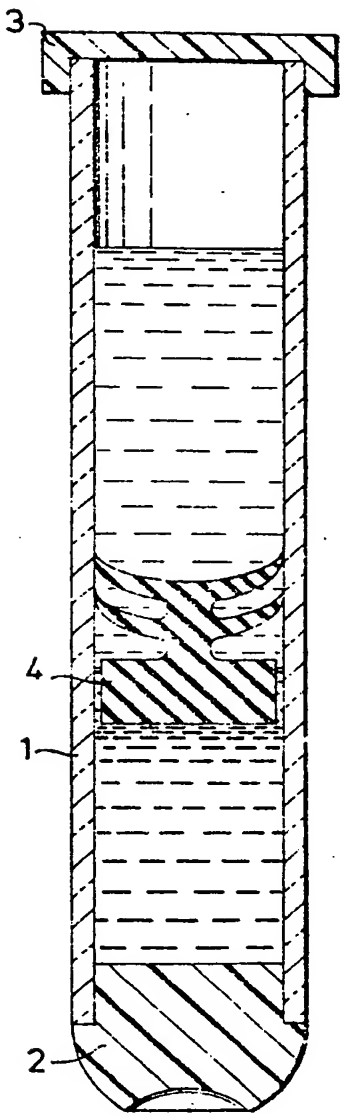


Fig. 4

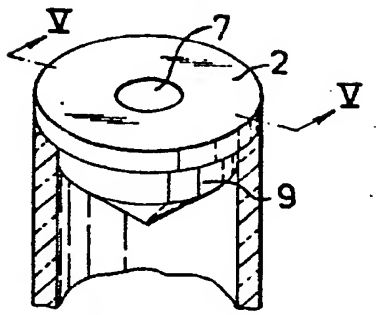


Fig. 5

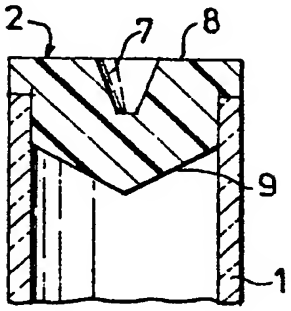


Fig. 6

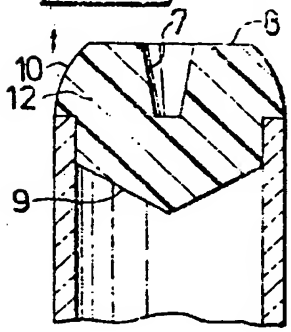


Fig. 7

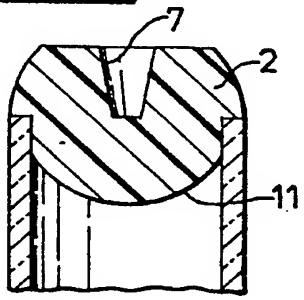


Fig. 8

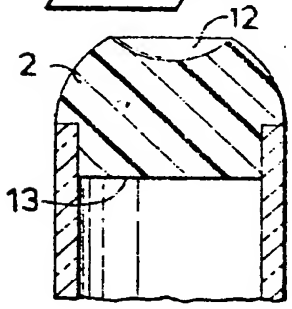


Fig. 9

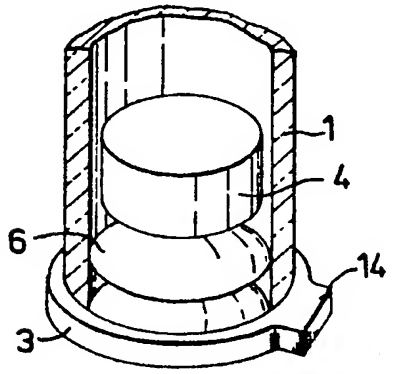
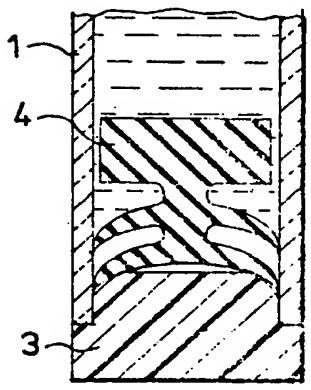


Fig. 10



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EUROPEAN SEARCH REPORT

0001200

Application number
EP 78 85 0010

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	US - A - 3 931 018 (NORTH) * Column 3, lines 59-68; column 4, lines 1-2; column 4, lines 29-34 and 54-68; column 5, line 1 *	1,3
	US - A - 3 951 801 (AYRES) * Column 1, lines 66-68; column 2, lines 1-12; column 3, lines 42-68; column 4, lines 1-16 *	1,3
	FR -A - 2 297 086 (EASTMAN KODAK) * Claim 24 *	2
	FR -A - 985 250 (OTTO) * Page 2, column 1, lines 26-38 *	4
	US - A - 3 930 413 (LAIRD) * Column 3, lines 3-9 *	5
A	US - A - 3 800 780 (ELLIOT) * Column 3, lines 6-12; figures 1,2 *	5

CLASSIFICATION OF THE APPLICATION (Int. Cl.²)

B 01 L 3/14
A 61 B 5/14
G 01 N 33/16

TECHNICAL FIELDS SEARCHED (Int.Cl.²)

B 01 L 3/14
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G 01 N 33/16

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23-11-1978	LAMMINEUR

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